

Predicting the Timing of Major Earthquakes

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Forecasting when a major earthquake will erupt -- within a window of two to three years -- could be possible, based on mathematical studies by researchers at UC Davis, Boston University and the University of Western Ontario, Canada.

The group, with colleagues at NASA's Jet Propulsion Laboratory, has previously forecast the likely locations of major earthquakes over a 10-year period. From Jan. 1, 2000, to the present, 17 of the 19 significant California earthquakes having magnitudes greater than 5 have been located on "hotspots" identified on a geographic forecast map of the state. Sixteen of those earthquakes occurred after the map was published in the journal *Proceedings of the National Academy of Sciences* on Feb. 19, 2002.

The new approach narrows the time window, but over a broader geographical area. Major earthquakes are still most likely to occur on the geographic hotspots identified previously, said John Rundle, director of the Center for Computational Science and Engineering at UC Davis, who heads the research group.

Working with Rundle and other colleagues, graduate student James Holliday found that major earthquakes in California having a magnitude greater than 6 cluster in time. The timing of large earthquakes is associated with periods when "bursts" of small earthquakes, with magnitudes of 3 or less, tend to be suppressed.

That is because small and large earthquakes are both related to the

tectonic forces, or stressing processes in the rocks below California, Rundle said. Suppression of the small earthquake bursts is associated with "spatial smoothing" of the stress field that produces the large earthquakes. A smoother stress field is capable of producing larger shocks than a rougher stress field, because earthquake ruptures can spread farther in a region of relatively even stress, Rundle said.

Northern California is currently in a period of suppressed smaller earthquakes. The opposite is true in southern California, where bursts of smaller earthquakes are relatively larger. According to the methods described in the paper, these findings indicate that northern California is currently at higher risk than southern California for a major earthquake.

The other authors on the paper, published in the Dec. 1 issue of the journal *Physical Review Letters*, are Donald Turcotte, UC Davis; William Klein, Boston University; and Kristy Tiampo, University of Western Ontario, Canada.

Source: UC Davis

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